Colour here, there and in-between

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RESEARCH ARTICLE

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Colour here, there, and in-between—Placemaking and wayfinding in mental health environments

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Abstract

Colour design in mental healthcare environments is acutely significant. Sensory acuity may be impaired through age, illness, or heightened stress and anxiety. While research has played a role in the development of guidance on the use of colour in such environments, this article suggests that this tends to be followed in a dogmatic, risk-averse manner and predominately without professional design input, leading to monotonous and under-stimulating environments. The article reports on two case study projects by the authors, involving user participation and student volunteers. These colour design installations provide examples of practice-led applied research within occupied healthcare facilities. The article discusses the significance of site-specific colour design in relation to place-making and wayfinding with reference to previous research that considers the role of colour as part of the everyday experience of all users, in contrast to an approach focused solely on the behavior of patients. It concludes that colour design knowledge developed and applied through "real world" live projects, involving students as part of their architectural education can address some of the shortcomings of laboratory or staged colour research.

KEYWORDS

architecture, colour, healthcare environments, interior design, place-making

1 | INTRODUCTION

In the UK, mental health provision is a growing concern, with one in four people experiencing mental illness at some point.[1] The general approach of medical professionals is to provide support for people to manage their illness and remain in their own homes. Intermittent short-stay admissions and chronic long-term care, where clinical treatments are required, are most frequently provided for users in a hospital environment. While purpose-designed new build healthcare facilities often include art installations and colour strategies as part of the design process, many people with mental health issues, including dementia, are cared for within facilities that are not purpose-designed. "Design for Dementia" is a growing topic for international research. Hilary Dalke led a colour design research group at Kingston University, that undertook substantive research into light and colour in healthcare environments.[2] The Stirling University Dementia Services Development Center is considered a leading international agency for research and application of design for dementia, including guidance on colour.[3] The social context of the users is also a consideration. Dementia is recognized as a growing

societal issue, "...in 2009, the World Alzheimer Report estimated that worldwide there would be 36 million people living with dementia in 2010, increasing to 66 million by 2030 and 115 million by 2050."[4] Formal research on the role of colour in dementia is slowly increasing and informing our understanding of how people may experience space.

In the United Kingdom, National Health Service (NHS) guidance on wayfinding acknowledges that illogical circulation routes are a common issue and that colour can aid navigation as part of a designed strategy.[5] Colour coding of departments by function is commonplace, but not always successful in aiding orientation. Collette Jeffrey's report for the NHS notes that "two out of three people did not notice colour-coding" and that "people can remember no more than five colours before they find it difficult to differentiate."[6] In addition, care is needed to avoid confusion with universal coding for safety signs. More significant is the need to identify key decision points within main circulation routes and to provide landmarks.[7] The provision of distinctive cues at decision-making points is noted by Chmielewski and Eastman,[8] while O'Malley et al[9] propose that memorable landmarks can act as beacons to aid navigation. Dalke et al[10] make the same observation that patients are more likely to refer to cues rather than signage to navigate, also that strategies for the use of contrast or colour coding and zoning "appear to be inconsistent" in the application. Research suggests that spaces that are characterful, easily navigated and with memorable landmarks are likely to improve the daily experience of healthcare environments, particularly where sensory acuity may be impaired.

Finding one's way is not only relevant to the navigation of physical environments. In relation to mental health, it is applicable at its deepest level, as a sense of self, or of life direction. Our need to construct cognitive maps of the environment is an essential pre-requisite for autonomy and self-reliance. In considering people with dementia, there is a subtle but significant difference between being "lost" and "missing."[11] We may suffer stress and anxiety if truly "lost" or disoriented, whereas relatives may report someone as "missing" when the person themselves may be content and not feeling lost. Wandering is a common experience and can maintain physical strength and a sense of well-being, whether inside or outside. However, spatial disorientation and a decline in wayfinding abilities are common early symptoms of the disease, so confusion is common.[12] More generally, visitors and users of healthcare facilities, are often anxious. Increased stress decreases the ability to absorb and process information. Spaces that are characterful, differentiated by colour and light can be considered part of a strategic use of colour for both wayfinding and contribute to the experience of space.[13] Furthermore, there has been a longstanding and widely evidenced relationship between well-being and nature that can contribute to reduce stress.[14] In some instances, the choice of colour internally and views externally to nature has been linked to improve recovery rates and the benefits of biophilic design, including the choice of colours found in the natural world, have been widely studied and specifically in relation to hospital design.[15,16] The naming of colour by association with nature, is embedded in most cultures and employed by Patrick Syme's in his book *Werner's Nomenclature of Colours* (1814).[17] The practice continues in the, often esoteric, use of colour names for paint ranges aimed at the general public.[18] However, as noted by Zena O'Connor,[19] and in a major study into the human response to colour in the environment conducted for NASA,[20] oversimplification, myths, and misunderstandings in relation to ascribed colour meaning and causal links between specific hue and human response have been largely discredited.

Mental health environments, therefore, have to negotiate a balance between security, safety, and inevitable restriction. Although guidance is available for care homes and hospitals, it appears to be applied often without professional design input or without reference to the specific context. Users have become conscious of a perceived need to get colour "correct" but maybe less confident about applying the advice.[21] In addition, research into colour in healthcare has been noted as frequently unreliable. A series of published papers provide useful summaries and recommendations based on literature reviews. Ghamari and Amor,[22] highlight the established benefits of colour in healthcare and make a case for further inter-disciplinary research, but also stress the "incongruity and fragmentation of previous studies" and the widely different needs of the user groups. Reporting on their "Stressed Space" research project on architecture and mental health, Connellan et al identify a list of 13 themes ranked as priorities for design, which places "Light" (including sunlight, daylight, Circadian rhythms, and colour) as second to "Security," with further references to colour crossing in-between the "Therapeutic Environment" and "Interior Design." They conclude that there is a lack of evidence-based empirical research.[23] Specific research on the effect of colour only serves to highlight the contingent nature of colour experience in relation to gender, age, cultural background, mood, light source, and other variables such as hue, light reflectance value, and saturation.[24] A further major literature U.S. review concluded:

> No evidence for a direct connection between environmental colors and emotional states

> could be found in the literature. Specifying particular colors for healthcare environments in order to influence emotional states, mental or behavioral activities, is simply an unproductive practice. ...Therefore, much of the knowledge about the implications of color in healthcare environments is based on highly biased observations, and pseudo-scientific assertions.[25]

Yet, as noted by Falk, Wijk and Persson, "...the effects of the physical environment may be of particular importance in healthcare settings, such as care homes, where the effect of refurbishment...has been demonstrated to have a big impact on residents."[26] Chalfont and Rodiek[27] have suggested that an inclusive approach to the design of satisfying and pleasurable spaces for all users is preferable to a focus on environments designed to limit challenging behavior in patients. However, colour research is known to be challenging in field conditions "... behaviourally specifying color is not aided by highly reductionist experiments that treat a "color" as a unitary stimulus event. In the real world, color inevitably occurs in a higher-order system of contrasts present in the setting. Tabletop models, slide representations, and color swatches inevitably these do little justice, and system variables are often constrained out by the experimental design itself."[28] What can be learned from fieldwork, what is different about practice-led inquiry, and how might we evaluate these "live projects"? In short, what does the colour do?

This article will argue that this general state of nervousness around the use of colour, combined with the limited amount of rigorously formulated research that is transferable to professional practice, may have contributed to a risk-averse/"tick box" approach to colour application, which has a limiting effect on the design of characterful and uplifting spaces.[29] The article will discuss the methods used in two practice-led projects to involve user groups and architecture student volunteers in the development and painting of colour installations within existing healthcare environments. The third project within a recently refurbished clinical psychology and counseling center within the University of Edinburgh is at the design stage. Both authors are qualified architects, in addition to their academic roles, and so have a background in the design and realization of building projects. The projects aim to make an immediate impact on the everyday lives of all building users. By identifying problem areas through user participation and on-site observation, the projects aimed to introduce site-specific colour installations—to transform the experience of the space, reduce the monotony, and create landmarks to aid wayfinding. The aim of this study is to situate the projects in the context of a review of relevant literature, to reflect on the outcomes, and to consider the value of practice-led applied colour research within the wider framework of formal colour research.

2 | CASE STUDIES

Like many healthcare facilities, the Royal Edinburgh Hospital—a U.K. NHS mental health facility—has evolved erratically over its 200-year lifespan. The main building, now known as Mackinnon House, was completed in 1813. It was established on an innovative ethos of activities, including meaningful work, sport, artistic endeavor, and access to nature. Today, the extensive grounds have been developed by a series of interconnected buildings. A new hospital that was intended to consolidate provision opened in 2017 and should have been followed by selective demolition of some of the poorer quality infills. This process has currently been delayed leaving a complex and confusing experience as staff, visitors, and service-users attempt to navigate the complex site conditions. The main hospital corridor extends to over 150 m and is a liminal space, occupied frequently by the same set of users, but with many transient visitors and short term out-patients (Figure 1). As noted by Dalke,[30] the use of "a single colour in a corridor, especially a long monotonous one, can desensitize and produce feelings of claustrophobia." Throughout this hospital, all walls are painted in "Magnolia" (BS 08 B 15) an off-white emulsion with mid-blue skirtings and door facings to provide visual contrast (refer Table 2). The result is highly monotonous, and the lack of distinctive spaces is disorientating.

FIGURE 1 Main hospital corridor [Photo: F. McLachlan, 2018]

2.1 | Project 1: Destinations and directions for a dementia ward

To the south of the hospital site, the Pentland Ward is the home for a community of long-stay dementia patients. The ward is focused on the care of people with dementia who exhibit high levels of stress and distress and provides accommodation for 12 to 14 male patients, most of whom will remain in the care of the hospital for the rest of their lives. This may be up to 20 years, but more commonly 5 to 10 years. The men are at different stages of the illness, with different abilities and symptoms. The ward, located in a 1970s building, was not purpose-built, every space looked similar and felt characterless (Figures 2 and 3). Staff and relatives make every effort to make the individual rooms homely, but the intermediate social and circulation spaces are where many patients spend large parts of the day. In some cases, the dark doors attract the patients, who then became disoriented and stand in the adjacent corners.

FIGURE 2 Dementia ward before colour installation [Photo: F. McLachlan, 2017]

FIGURE 3 Dementia ward before colour installation, dark doors distract patients [Photo: F. McLachlan, 2017]

The ward has taken the opportunity to work on a number of collaborative projects through creative arts organizations, most notably Artlink, an arts and disability organization who have a base on the hospital grounds.[31] Artlink, who is a third party agency, which works across a wide range of healthcare facilities, organizes open days, cultural events, art, and gardening clubs. These have tended to be activity-based projects for service-users and patients working alongside an artist, sculptor, or musician. The colour installation shifted the focus from patient activity to the immediate environment of the public areas of the ward. Individual bedrooms are private and so were not part of the project. Unusually perhaps, the chief staff nurse is given authority to operate the ward in relative freedom and readily agreed to the colour installation. He was keen on the idea to break up the monotony of the ubiquitous pale yellow wall colour, to make the environment more welcoming for families and staff as well as for the patients. McManus and McClenaghan noted that,

> ...therapeutic environmental design is an important factor in maximising the functioning and quality of life of people with dementia. The quality of the environment has the greatest impact on those with the least physical and/or mental capacity, so good design may compensate for impairment.[32]

The colour design was developed through consultation with a range of users. A vital part of the process was to develop methods of communication. The first technique made use of a focus group of nursing staff and family members in the carer's forum. All participants were volunteers who were asked to highlight specific areas on paper copies of a perspective plan drawing taken from a simple three-dimensional computer model that they felt were problematic and to try to articulate the reasons (Figure 4). The drawings produced a remarkable consensus, and the design then was able to focus on the areas identified most consistently by the users. Circulation routes were felt to be confusing and disorientating, with a long internal corridor, incorporating several changes of direction. Lighting levels are poorer than would be the norm in a purpose-designed space. At both extreme ends of the ward, the corridors terminate in “dead ends.” In one of these, a dark red and brown doorway to a patient's room attracted other patients who rattled on the door

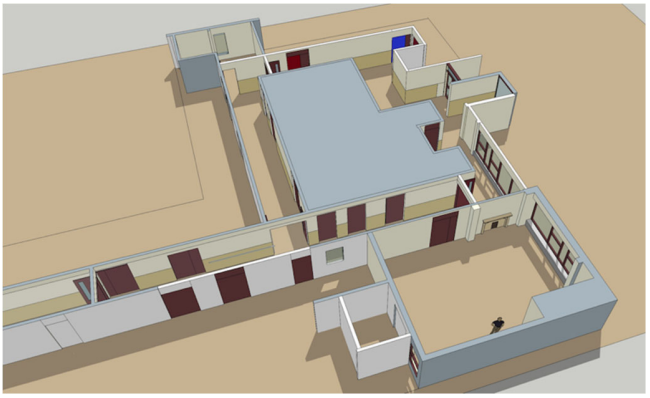


FIGURE 4 Design process—Computer model used for consultations [Author]

FIGURE 5 Design development sketch [Author]

handle, went into the unlocked bedroom, or simply got stuck in the corner. Each instance required a staff member to retrieve the patient, and this repetitive activity was clearly identified as a key concern for nursing staff. The rattling of door handles is also noisy and can lead to stressful situations. Wandering is a common behavior in people with dementia. Patients may not be necessarily disorientated, but as noted earlier, they may walk purposefully to alleviate stress and boredom. The second most identified issue in the consultations was the lack of differentiation between spaces. This was the case both within the main circulation spaces and in the public rooms. In a second focus group, carers (predominately the partners of the patients) emphasized a need for spaces that are more homely and sophisticated and small places within the circulation areas where they can sit with their relatives. Two themes emerged, which clarified the design response, namely "destinations" and "directions".

As an architect, a natural starting point for any design is the specific context. This extends beyond the function of existing spaces, the physical configuration, attributes, and material surfaces of the building, to include the environmental qualities of artificial light, sunlight, and orientation and in response to the social context of the users. Sketch designs that focused on the identified problem areas were presented back to the focus group along with an initial colour palette. The hand-drawn and coloured sketches (Figure 5) were pinned up in the relevant spaces around the ward. The concepts behind the design development and the proposed colour palette were explained to all users through newsletters at regular intervals to inform them of the project and to invite questions. The colour design concept that evolved after site observation was to introduce colour block walls in specific areas, overlaid with a repeated motif to give a suggestion of direction and to accentuate key corners. The dimensions of the colour block panels within the circulation were restricted to upper walls above the existing permanent plastic-coated dado. In two areas, the extent of the colour block was adjusted on-site in response to users' comments. In the two public rooms—dining and living room-the absence of the dado allowed the colour block to extend the full height. The use of pattern, through paper cut-outs, had been restricted to the patient's rooms, which are decorated by their families to reduce the institutional feel. The author observed that some patients enjoy tracing their fingers around objects and this led development of a rounded square motif, derived from wallpaper designs dating from the period of the building, but with a form that was intended to be calming. The design could be oriented using an inserted oval depending on its placement within the square and using the contrast of both hue and saturation to stand out against the background colour of the applied colour block walls. The rounded square with inserted oval suggests a direction of travel, and at the two extreme ends of the corridor, this was placed on a diagonal block of green leading upwards away from the problematic corners (Figure 6).

The next stage was to refine and adjust the palette. Architecture student volunteers, most of whom were undertaking an elective course "On Colour: in Architecture," made a series of large colour samples (Figure 7). The students visited the ward to gain an understanding of the environment and to pin up the test samples alongside the sketches at locations around the ward. These were left in place for around 2 weeks to allow the users to experience the colours and how the perceived colour changes through the day in different weather conditions. A final focus group, held as part of the weekly "Carer's forum," provided feedback after which a few of the colours were adjusted as shown in Table 1. The event was publicized through a newsletter

FIGURE 6 Completed project—seating area in corridor [Photo: F. McLachlan, 2018]

FIGURE 7 Architecture students making large colour test swatches [Photo: F. McLachlan, 2018]

and participants were all volunteers from nursing staff working on the ward and patients partners. The colour codes indicated are Dulux Trade notation, with an equivalent L, a, b provided.

Initially, the strongest colour in the palette was a warm terracotta red (29YR 27/355) with an Light Reflectance Value (LRV) of 27 and a saturation of 355/1000. Under the poor lighting, however, this felt flat and carers suggested a more saturated, livelier red (10YR 21/436) despite having a lower LRV (22). This colour was placed at the most critical intersection with the aim of making a memorable place within the circulation (Figure 8). Several tests were made with large sample panels pinned up on-site before the red was confirmed. A mid-green tone (95YY 39/329) that had been proposed near the ward entrance was not popular with staff and was replaced by the purply gray (54BB 39/103). The colour design responds to the particular light conditions and is designed to vary in appearance during the day. In the main spaces such as the dining room, the colour design acts volumetrically to subdivide the large space using block colour that wraps round an internal corner to imply a more intimate room within the room (Figure 9). A combination of warm tones and bright hues are further enhanced by the south light in this space, which looks onto the garden. The least saturated colours with a higher LRV (30RB 73/016 and 10 YR 55/037) were used in the living room area, which faces west, but is relatively dark, where the carers had expressed a desire for a more homely and sophisticated palette.[33]

Six months after the Project 1 installation, a questionnaire was used to obtain feedback. There are a limited number of users to this closed ward namely; clinical staff, nursing staff, partners of patients, and cleaning staff. The chief staff nurse encouraged the users to complete the questionnaire on a voluntary basis over a 2-week period. Users were asked a series of questions in four themes: wayfinding and directions, the general atmosphere/ character of the spaces, their experience of the effect of the colour installation on themselves and through observation of the patients. Findings are noted later in the article.

2.2 | Project 2: Colour for the Corridor

The second project completed in 2019, was designed by the authors in response to an invitation by the health trust that coordinates arts and participatory projects across a range of healthcare facilities. It was considered a pilot project within a section of the very long main circulation corridor at the hospital. Signage along the route is varied in its execution and formal signboards are frequently supplemented by random paper posters tacked onto the walls with tape. There are a number of very good artworks throughout the corridors, but many are lost against the general confusion of the surfaces.

The design methodology established in the first project was repeated. A simple 3D computer aided design (CAD) model was developed to be included in the form of diagrams within a written proposal to the hospital. The colours, which were restricted to wall surfaces, had to accommodate the existing colours of the flooring and enameled steel door frames that could not be changed within the budget constraints (Table 2). Using colour test pots, large swatches were painted by architecture students in the same process as the dementia ward. The

TABLE 1 Project 1 Colour palette information

Project 1: Colour palette			
Existing palette		**Dulux Trade Code (unless otherwise noted)**	**L, a, b comparison** *(https://www.e-paint.co.uk/Dulux_codes.asp)*
Upper walls -matched to Dulux Trade code on site		50YY 83/171	93.01, 0.00, 17.10
Lower walls - matched to NCS code on site		2020 Y 20 R	75.62, 6.81, 27.29
Flooring -Linoleum marbled		50GY 72/012	87.87,-0.85, 0.85
(matched to approx Dulux code on site)			
Dining room			
Colour block TV wall		10YR 55/037	79.04, 3.30, 1.68
South facing wall		19BG 61/207	82.38, -17.73, -10.68
Column at exit door to garden		02RR 35/376	65.75,34.96, -13.84
Living room			
Wall at fireplace		30 RB 73/016	88.45, 0.94, -1.29
Wall at storage unit		10YR 55/037	79.04, 3.30, 1.68
Circulation block colour panels			
Corridor colour block walls		54BB 39/103	68.75, 0.32, -10.29
Corridor colour block walls		10YR 21/436	52.95, 38.85, 19.79
Diagonal direction panels at corridor ends		90YY 62/264	82.91, -8.16, 25.11
Motifs			
Gold yellow		50YY 62/309	82.91, 0.00, 30.90
Saturated mid-green		95/YY 39/329	68.75, -11.39, 30.87
Colour block colour aslo used in motif		54BB 39/103	68.75, 0.32, -10.29
Colour block colour aslo used in motif		10YR 21/436	52.95, 38.85, 19.79
Colour block colour aslo used in motif		90YY 62/264	82.91, -8.16, 25.11
Colours omitted after testing on site			
Terracotta 1		*29YR 27/355*	58.97,28.88, 20.64
Terracotta 2		*26YR 18/404*	49.50, 33.41, 22.71
Purply grey 2		*90BB 32/126*	63.34, 3.89, -11.98
Stone 2		*67YR 56/055*	79.61, 3.34, 4.37
Pink 2		*95RR 56/237*	79.61, 22.24,8.20
Note in Dulux notation the LRV figure is indicated - eg 42% LRV in the code 90BG 42/106. Lower LRV numbers are darker			

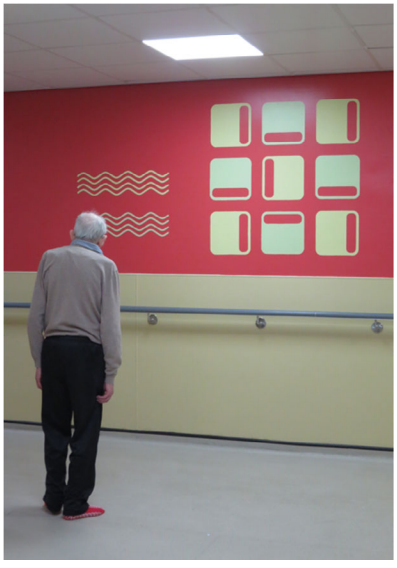


FIGURE 8 Completed project—landmark red wall [Photo: F. McLachlan, 2018]

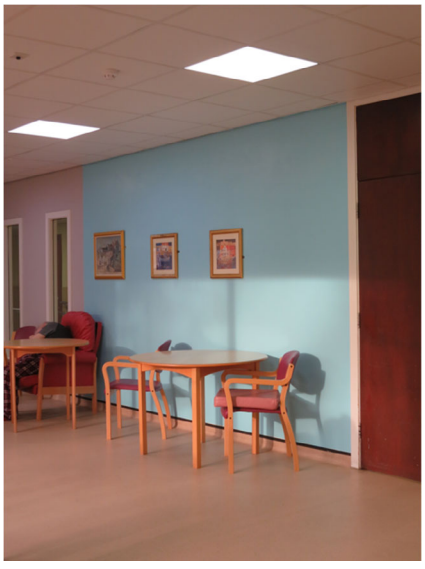


FIGURE 9 Completed project—dining room [Photo: F. McLachlan, 2018]

FIGURE 10 Architecture student volunteers help to paint the installation [Photo: F. McLachlan, 2019]

FIGURE 11 Students help paint the Wall of the First Frost [Photo: F. McLachlan, 2019]

large swatches were checked on site under different light conditions and two colours were adjusted after observation. A newsletter was prepared by the author and circulated in advance by the hospital staff. Finally, the paintings were installed over a week, with 19 student volunteers working in a rota together with the authors (Figures 10 and 11).

As this was a pilot project, it was important to establish an easily understood colour strategy that had the potential to be extended by the hospital in the future.[34] In this case, the aim was to foster a sense of place at significant moments- using large scale colour installations, to aid wayfinding through landmarks- but also to reduce the monotony of the existing environment. The colour palettes chosen were intended to reinforce the relationship of the hospital to its extensive gardens and to gardening activities, both of which were established over 200 years ago as part of a therapeutic approach for the hospital community and continued to the present day. The colors emerged following nature walks in the site and surrounding area. The technique of deriving a palette from the site context has been established through the work of Lenclos and Lenclos, where mineral and other fragments were colour-matched to swatches in order to develop a site-specific taxonomy of colour.[35] In urban settings, colour matching of carefully observed palettes was further developed by Tom Porter and more recently by the Haus der Farbe, for example, in their Farbraum Stadt: Box ZRH project, which documents thousands of façade colours and synthesized them to form a city palette for Zurich.[36] McLachlan has likened this process to a "close reading" of the context.[37] In the case of this project, a digital colour extraction was employed using Adobe "Capture" software as a starting point. The colours were then edited, reviewed, and tweaked by eye to compose a recognizable "Autumn" palette used in the main entrance space. A second wall painting, based on a winter palette, was developed by the co-author in parallel with his doctoral research. The wall painting, titled "The First Frost" refers to a transitional period from autumn to winter when frost forms on the surfaces of natural objects, also known as the Descent of Frost—a solar term- in China.[38] As part of the overall colour strategy, this wall painting is placed in a site-specific location between the palettes of autumn and winter. The moment of the first frost is also captured in western poetry, such as by Daniel Anderson, Roberta Teale Swartz, and Edwin Curran, etc.[39] This term is therefore not only associated with the visual effect of the colours, but also contains rich cultural meanings. As noted in the introduction, many colour associations and meanings are deeply embedded in our consciousness and are understood to be socially and culturally constructed, and meanings, therefore, vary.[40] Meanings have been intertwined with colour names to the extent that it is impossible to dissect whether the trigger comes from the name of the colour appearance.[41] However, as noted previously, the use of specific hues to trigger a universal emotional response is known to be unreliable.[42] What one person experiences, in a particular time and place, may not be so for another. Personal memories may be evoked by specific colours and, although there are some commonalties cross-culturally, responses, as noted by Deborah Sharpe, are "not biologically necessary or organically conditioned, but...operationally learned" and therefore our experience of colour will always remain highly contingent.[43,44]

The two palettes developed for Project 2 are contrasting, with one being predominately yellow-red, red-brown, and soft greens using in the entrance hall

FIGURE 12 Completed reception hall with Autumn palette. [Photo: E. McLachlan, 2019]

FIGURE 13 Wall of First Frost seen from the interior perspective [Photo: E. McLachlan, 2019]

(Figure 12). The winter palette uses more blue-greens and "cooler" tones (Table 2).

The "first frost" colour palette does not intend to offer a precise interpretation. Each colour was abstracted from frost-wrapped objects in nature—such as a tree trunk, branch, leaf, grass, and fruit, etc. The extracted hues were adjusted by eye and composed into a new configuration combining brown-purple, green-gray, bright yellow, and white rectangles against a blue-gray background (Figure 13). The adjacent wall is painted in a strong orange also used in the autumn palette, which along with the bright yellow, counterbalance and warm the cooler tones. Deep plum is applied on the door; with brilliant white on the skirting and door frame.

The corridor is a semi-open space, which separates itself from the outside world with a glass wall, however, there was no direct colour connection between the interior space and the outside space. The original bland colour of the wall behind the glass did not attract attention from outside. Seen from the car park, it was an

TABLE 2 Project 2 Colour palette information

Project 2: Colour palette			
Existing		**Dulux Trade Code (unless otherwise noted)**	**L, a, b comparison** *(https://www.e-paint.co.uk/Dulux_codes.asp)*
Flooring matched to Dulux Trade code on site		23YR 08/237	33.98, 19.91, 12.86
Yellow doorway matched to B.S code on site		BS 08 E 51	72.59, 21.05, 74.48
Existing walls- matched to B.S code on site		BS 08B 15 Magnolia	92.59, 1.34, 9.79
Timber windows- matched to Dulux Trade code on site		48YR 06/091	29.41, 6.53, 6.33
Skirtings - NHS Scotland		Pantone 2995 C	62.55, -27.76,-42.04
Doors - NHS Scotland		Pantone 288 C	18.63, 8.32, -46.55
Autumn			
Autumn band		70 RR 24/096	56.09, 9.48, 1.5
Main wall and band		90 RR 11/257	39.58, 24.44, 7.94
Autumn band and column		90YY 35/169	65.75, -5.22, 16.07
Autumn band		90 YY13/177	42.76, -5.47, 16.83
Autumn band and high level above doors		60 YR 24/439	56.09, 28.51, 33.38
Main wall and Autumn band		10YY 35/543	65.75, 16.78, 51.64
Behind Signage		35YY 59/533	81.29, 6.26, 52.93
Doors		10RR 08/100	33.98, 9.51, -3.09
Skirtings		21BG 45/002	72.89, -0.17, -0.11
First frost			
Main wall		90BG 42/106	70.87, -4.81, -9.44
Wall panels		35YY 59/533	81.29, 6.26, 52.93
Wall panels		74GG 50/059	76.07,-5.80,-1.11
Wall panels		00 NN 72/000	87.97, 0.00, 0.00
Doors		10RR 08/100	33.98, 9.51, -3.09
Skirting and facings -Brilliant white Dulux Trade		Approx NCS 0300-N	96.48, 0.02, 1.71
End wall		60 YR 24/439	56.09, 28.51, 33.38
Note in Dulux notation the LRV figure is indicated -eg 42% LRV in the code 90BG 42/106. Lower LRV numbers are darker			

FIGURE 14 Color installation viewed from the car park [Photo: E. McLachlan, 2019]

inconspicuous corner obscured by the branches and leaves of a tree and surrounded by the gray tiles and dull façade of the building. In comparison, the new installation is not only designed from the interior perspective but also for the exterior view. The repainted walls act both as a refreshing background for the green space in front of it and an antidote to the dreary surrounding façades (Figure 14).

3 | FINDINGS

As part of the design development for both projects, specific points in the original buildings had been identified as disorientating. Published research suggests that the use of memorable graphic images, combined with vivid colour, can aid navigation. Chief staff nurse on the dementia ward, (Project 1) said of the renovated colour design:

> There has noticeably been more movement from the patients around the space and patients seem to be making more use of the living area, which is generally thought to be more homely than previous. The dispersal of patients around the ward can diffuse tension. Patients will also sit with relatives in the circulation areas as well as within private rooms. Since the installation was finished, we have also been inspired to add a memory tree and poems on the walls and surfaces.

Staff noted that they did not tend to make direct reference to the colour block in directing visitors, however, one responded—"that the different aspects of shapes and colours break up the ward into separate sections and help give an appearance of a smaller space." Another noted, "...a more friendly and welcoming environment. I feel as if a change of scenery breaks up the ward for the guys who pace with purpose." Further that "...it has a calm feeling, light and airier and this helps patients with dementia feel calm themselves."[45] The majority of respondents, who were predominately nursing staff, had not observed the patients making any reference to the colour in terms of wayfinding. However, the most remarkable finding was that the men are no longer prone to stand in the corners. The strong red and patterned panel seems to act as a beacon and be sufficiently memorable to direct the patients at the most confusing intersection. Further tangible evidence is that incidents of aggression between patients or with staff, which must be formally reported, have also substantially reduced since the installation. Although this could be due to a number of factors, staff cited that the patients are making more use of the "living area," which is felt by staff and family carers to be more homely than previously. Patients will also sit with relatives in the circulation areas as well as within private rooms.

The questionnaire showed a series of "before and after" photographs and asked users to consider a list of descriptive words relating to the feeling and character of

TABLE 3 Extract from questionnaire showing "before and after" of each space

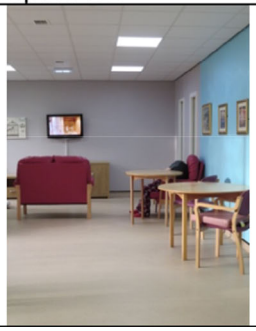
		Space before	Space after
A.	Dining Room		

TABLE 4 Excerpt from questionnaire analysis on the character of the spaces (number of responses noted for each word)

BEFORE		AFTER	
Cheerful		Cheerful	8
Boring	6	Boring	
Gloomy	6	Gloomy	
Monotonous	6	Monotonous	
Sophisticated	1	Sophisticated	1
Yellow	4	Yellow	
Plain	7	Plain	
Friendly		Friendly	9
Homely	1	Homely	5
Confusing	3	Confusing	2
Lively		Lively	8
Uplifting		Uplifting	7
Characterless	4	Characterless	
Dull	5	Dull	
Institutional	8	Institutional	
Too bright		Too bright	
Dark	1	Dark	
Bland	7	Bland	
ADD your own words:		**ADD your own words:** Vibrant, Fresh, Subtle	

the ward (Tables 3 and 4). There was a significant uplift in the positive language used. However, the Chief nurse emphasized that when staff morale is good, they are more likely to be calm and to take things slowly with the patients. The more characterful spaces combined with the "place-making" using colour block to define spaces within the circulation areas have influenced the dispersal of the patients around the ward. This can diffuse tension, and therefore, reduces the number of incidents between patients, which were noted 6 to 9 months after the installation. This may be considered a direct outcome of the installation.

Project 2: "Colour for the Corridor" also responds to careful on-site observation. Despite the ample capacity of the spaces and the sparse occupant flow, some pedestrians still lose their direction in the corridors. This inefficient and stressful experience is exacerbated by poorly considered signage and a lack of identifiable visual cues. The intention of the installation is to promote the independence of the users to help them to orientate themselves within the corridor. The cooler background tone of the "first frost" wall is used to strengthen the identity of that specific space in contrast with the autumn space, as well as other spaces of the hospital, offering important wayfinding cues for pedestrians. The design using horizontal coloured rectangles on the wall guides pedestrians to walk through the corridor from one end to the other (Figure 13). The brightly-colored spaces are intended to relieve the users' anxiety when visiting the hospital, to create a more welcoming atmosphere compared to the previous under-stimulating environment.[46] Feedback from the hospital community has been garnered through the Patients' Council; "wow, what a difference...looks more like a modern, welcoming building now"; "beforehand, the corridors were very institutional, clinical and depressing - now they are eye-catching, and the colours help draw you in to the building"; "I liked the geometric shapes and use of panels with complementary colours"; "perhaps patients from ...rehab wards would be willing to assist in further painting projects...there could be employability opportunities for patients here". Some members thought the color scheme could have been even brighter and more vibrant: "I felt the colours were a little too muted, pale, and flat, and the colour palette was too restricted. More vibrant colours could have helped things 'pop' a little better..."

The positive response to this pilot project has given the hospital the confidence to extend the project into the main corridor. As suggested by one respondent above, it is intended to involve the hospital community to explore individual and collective memories and associations of seasonal palettes before painting the next sections of the corridor. The lead author has made an initial selection of possible "Spring" and "Summer" palettes that are now being used by occupational and art therapists with patients. It is expected that the visual experience of a specific seasons will be personal; and memories of specific scenes may be unreliable; moreover, people's colour memory will shift, even for familiar objects, as time passes.[47,48] However, the fact that the hospital is now using

FIGURE 15 Completed installation to aid wayfinding [Photo: E. McLachlan, 2019]

the colour project to stimulate discussion about colour is encouraging (Figure 15).

4 | DISCUSSION

In both of these installations, the use of colour has been focused on the addition of a layer of highly site-specific wall paintings that are intended to aid navigation, provide memorable landmarks, and create more characterful places for the users. The actual hues and tones used were chosen as part of the color design strategy, rather than by a dogmatic approach or as overt colour coding for wayfinding. Each project responds to place, to the orientation in relation to daylight and views, and to the social and cultural context of the users. In both cases, the wall paintings can be considered both art and architecture. Perhaps unlike an artwork, the installations have been designed in response to users, and in response to the function of the spaces, which are predominately public and semi-public routes. Unlike architectural design, the wall paintings have been installed by the authors directly on the surface and in fully occupied premises. Both projects have involved some risk-taking on the part of the hospital, but they have received an overwhelmingly positive response. Most significantly, the colour has acted to reduce the institutional feel of the spaces, to provide a more stimulating sensory environment and to support wayfinding.

In terms of a formal research study, there are limitations that should be noted. The opportunity provided by such "live" practice-led projects is to involve users in the design of their environment, to encourage a site-specific response to evolve as opposed to a dogmatic application of the guidance. The value of practice-led research may be seen in contrast to the laboratory or staged colour research, which cannot replicate the complex situations encountered in real-life situations, however, the ability to evaluate the results is also limited. In Project 1, for example, focus groups were self-selecting based on volunteers. It is acknowledged that this is likely to affect their comments as they became engaged in the project. A variant of the "Hawthorne effect" may also have influenced the positive responses to the "before and after" questionnaire. The simple act of change in the environment, a feeling of investment and involvement of users, and an awareness of being studied may be a factor in the shift in the perception of the space.[49] The severity of the patients' illness meant that they were unable to verbalize their experience. Measurement of neurological responses, while possible, can be intrusive and was not considered appropriate to these projects. One might expect a different response in a dementia care home setting where there would be a wider range of respondents—most critically—the residents themselves. The findings from the questionnaire are therefore limited to the verbal responses and observations of staff and regular visitors.

Further innovation has been to involve architecture students as volunteers to paint the installations. The projects provided a direct experience of the potential of colour to transform a specific series of spaces. The students helped to produce large sample panels, visited the hospital to understand the existing situations, meet the users, and observe the way the ambient light affected the appearance of the large sample panels in the appropriate locations. Perhaps most significantly, the authors and students painted the installations together and so were immersed in the everyday use of the spaces, confronted and questioned daily by users, and an understanding of the impact of the colour developed through this direct contact within a challenging real-life context. The potential for knowledge transfer is therefore significant through direct engagement between designers and users as part of this process. In the case of both projects, the hospital community developed more confidence in the application of colour and were more willing to experiment, while the researchers and students developed their understanding on the needs of users of design of mental health environments.

5 | CONCLUSIONS: WHAT CAN COLOUR DO IN THESE ENVIRONMENTS?

The general thrust of recent research in mental health environments has been to support a shift from a medical terminology of mental illness as a condition, to consideration of the quality of everyday living, and working experiences for all building users. Colour is experienced as a complex combination of physiological sensing and cognitive interpretation. As cognitive capacity deteriorates, the sensory experience of colour can be dulled. As the eyes grow dim, or yellow slightly in old age, the perception of space will alter. A consistent observation in each of these projects was the overwhelmingly monotonous, bland, and characterless spaces. Each of these "live" projects aims to apply an emerging understanding on the role of colour within such environments to aid wayfinding and provide more varied, characterful spaces for all users.

Further research is planned through a third project in a center for public counseling and clinical psychology treatment, based in the University of Edinburgh premises. The center is staffed predominately by counselors in training and postgraduate students with a wide

international mix. Research and education in practice are therefore embedded in their program.[50] With limited time and funds to renovate the property, a converted residential flat in an 18th-century courtyard, a single warm gray paint has been applied throughout every space and surface. Although this unified a series of disparate rooms, the immediate effect was bland, and somewhat dispiriting. The staff were making efforts to use lively colours in the furniture and soft furnishings but were very aware that the spaces would benefit from a more strategic colour design. Rather than impose a colour design, using the methods developed for Projects 1 and 2, the author has developed a 3D CAD model to discuss with the staff and gain a better understanding of how the consulting rooms and waiting spaces would be used through a focus group. Significantly, in initial discussions, counselors referred to their spatial practices. For example, it is crucial to avoid hierarchy between client and counselor, meaning that room layouts must not be static but allow for the client to choose where to sit. The emerging colour design strategy is to "wrap" the spaces in a partial manner, responding to the sense of security afforded by the armchairs and is intended to adjust the volumetric experience of each room. This project will provide an opportunity to broaden the practice-led research through a cross-disciplinary research team.

The projects have been partly prompted by a sense that, despite evidence-based design guidance, in practice, such "toolkits" may be interpreted and applied uncritically, often with minimal professional design input, and largely without reference to the specific context. In relation to colour design, dementia care facilities tend to focus on contrast, often simplistically interpreted as a contrast in hue. While published guidance documents may be carefully nuanced in their understanding of colour, this article has highlighted the need for an integrated approach to colour design beyond the "tick box" application of a reductive set of principles. Although well-intentioned, guidelines can be applied dogmatically and to avoid risk, which contributes to characterless, monotonous, and under-stimulating health care environments. The demonstration projects offer a more holistic process, including users in the development of a distinctive, site specific, design. The practice-led colour design research in the "real world" setting, also address some of the shortcomings of laboratory or staged colour research, as noted in the introduction. Although clearly not the norm, one of the additional benefits of the authors painting the installations themselves was being on site for a prolonged period, observing and interacting with the users and meeting with staff who are willing to be contacted to further the research. The projects also demonstrate the potential for education in colour design, through engagement in a live student project. These projects focus on specific, concrete problems, and make an explicit demonstration of the transformational potential of colour on people's everyday experience of space and are intended to increase awareness of the need for design knowledge to be developed and applied in practice.

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DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are available in the supplementary material of this article

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